VTX Jet Multiplicity Trigger Study

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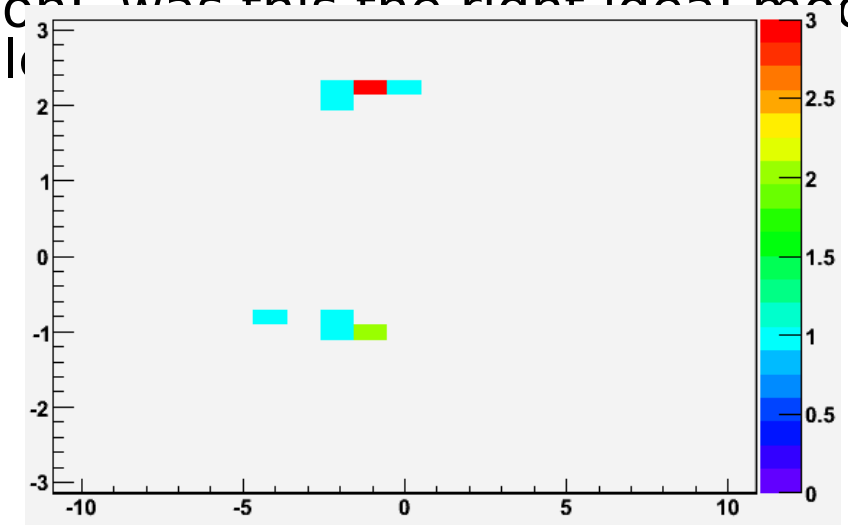
The Idea: from an exchange of emails

- Craig: local multiplicity cluster (a.k.a. "jet"), i.e. n contiguous hybrids have a hit
  - and this happens for both layers.
- Alan:
  - “Using the fast-or we can build a trigger which find the vertex to within a cm or so. The granularity is on the order of a square cm, I guess the jet would have large opening angle. The inner pixel is 2.5 cm away, so the granularity in phi is about 0.4 radians [… second layer 0.2 rad]”
- Thinking about possible ways of triggering on jet physics, I was curious to see what kind of efficiency such an idea might have for jets
- So I started with a very simple PYTHIA study

My Understanding/Mock up

- Running “default parameters” PYTHIA
  - Note still verifying basic aspects of the events
  - Just high pt di-jet events:
    - “Hard QCD Processes” (qg->qg, …) z vertex = 0
    - With pythia.SetCKIN(3, ptmin); → ptmin 5,10,15 GeV/c …
- Mock up vtx 2nd layer “trigger” acceptance:
  - 1cmx1cm segmented cylinder of radius 5cm
  - Assume z length of barrel 21.8 cm (from EM Colorado talk)
  - Note: hard to find geometry: TDR/CDR? Web page passwd?
  - Discussion: was this the right idea; modify geometry? try small

Phi

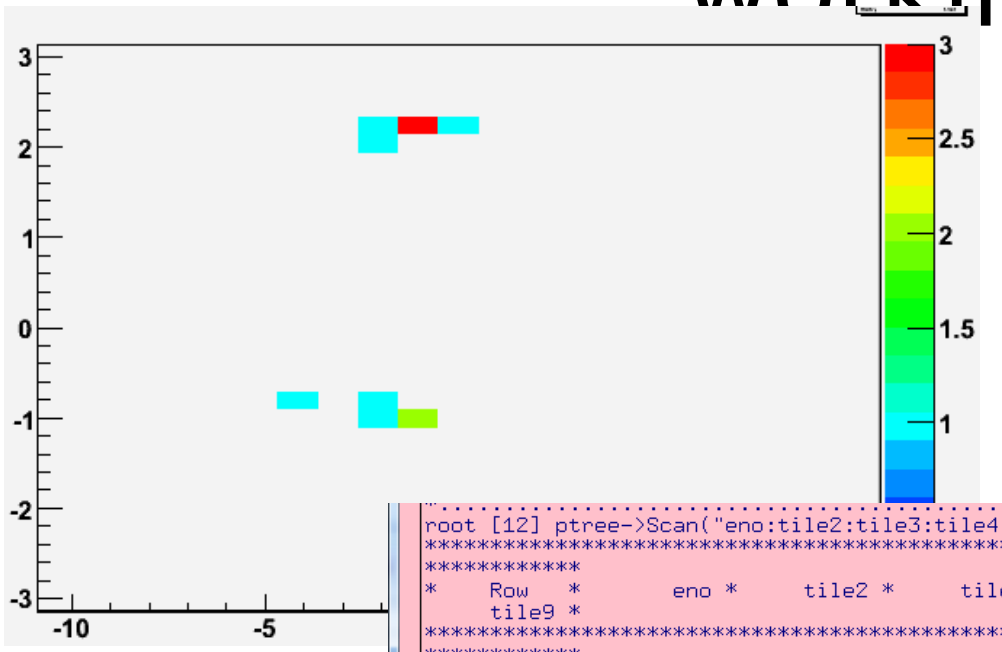


Nhits > 1 GeV (h+- & Pi0)

“Clustering”

- Actually do simple overlapping tile trigger
  - tile sizes 1,2, 2x2 (tile4), 3x3 (tile9), 4x4 (tile16)
  - plus “everything inbetween” : meaning by examples:
    - tile4,9, 16-→ all 4, 9, 16 “pixels” hit
    - tile5: a 3x3 tile had 5 tiles hit (not necc. contiguous).
    - tile10 : a 4x4 tile had 10 hits
    - etc…
- More complicated clustering maybe later (is this more realistic challenge)

Results so far (seems to be working)



Don’t take too seriously yet, but events look OK so far

```
root [12] ptree->Scan("eno:tile2:tile3:tile4:tile5:tile6:tile7:tile8:tile9")
************************************************************************************************************************
*    Row   *       eno *     tile2 *     tile3 *     tile4 *     tile5 *     tile6 *     tile7 *     tile8 *     tile9 *
************************************************************************************************************************
*        0 *         0 *         1 *         1 *         0 *         0 *         0 *         0 *         0 *         0 *
*        1 *         1 *         1 *         0 *         0 *         0 *         0 *         0 *         0 *         0 *
*        2 *         2 *         0 *         0 *         0 *         0 *         0 *         0 *         0 *         0 *
*        3 *         3 *         1 *         1 *         0 *         0 *         0 *         0 *         0 *         0 *
*        4 *         4 *         1 *         0 *         0 *         0 *         0 *         0 *         0 *         0 *
*        5 *         5 *         1 *         0 *         0 *         0 *         0 *         0 *         0 *         0 *
*        6 *         6 *         1 *         1 *         0 *         0 *         0 *         0 *         0 *         0 *
*        7 *         7 *         0 *         0 *         0 *         0 *         0 *         0 *         0 *         0 *
*        8 *         8 *         1 *         1 *         0 *         1 *         0 *         0 *         0 *         0 *
*        9 *         9 *         1 *         1 *         0 *         0 *         0 *         0 *         0 *         0 *
************************************************************************************************************************
```

Plan: finish this study

- Study effic. as fn of tileN
- Study effic. as fn of pT jet (this could be soon after this talk—may post some more slides…)

- Also try combination (II) of this trigger w/ a single high pT EM particle (EMCal 2x2/EMCal 4x4)

- If eff looks OK study “mock-up” rejection
  - in sim? probably (or maybe from real data?)
- If that all looks good, then do REAL sim study?

- Discussion:
  - Other Better Ideas?